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Chapter

Nomophobia Kids and Proprioception

Giridharan Vaishnavi

Abstract

Proprioception is the sense of self movement and body position. The CNS integrates proprioception and other sensory system such as vision and vestibular system in order to create body position, movement and acceleration. It is developed by movement and works with surroundings. Children using smartphones for a long time result greater impact on the sensorimotor function and their proprioception is affected. In this topic, the write up is going to be regarding the proprioceptional deficit and the problems associated because of that of children using mobile phones for a prolonged period of time. The proprioceptive system has an extensive influence at the protection of human fitness. When the proprioception is dysfunctional, the vital anxious device does no longer recognize the ideal fame of tonicity of the muscular tissues at rest or in motion, does no longer combine effectively the records that comes from sensory receptors, and has issue in modulating multi-sensory integration, with outcomes in motor behavior and cognitive function.

Keywords: nomophobia, proprioception, smart phone, feedback loop, feedforward loop

1. Introduction

In the last few years, the usage of smartphone has been progressively increased worldwide among kids. Nomophobia is described as an experience of anxiety due to fear of not having access to mobile phones. Smartphone addiction leads to restless night, anxiety, social isolation, nervous breakdown, weight changes, insomnia & anger [1]. Nomophobia is described as" the discomfort or tension because of the non-availability of a cell cellphone, non-public computer (laptop) or any other digital device" [2].

Nomophobia is described as "the soreness or tension as a result of the non-availability of a cellular telephone, personal laptop (pc) or any some other digital verbal exchange device" [2]. Clayton et al. references Belk (2013) of their explanation of smart-phone loss as the "unintentional lack of a ownership need to be regarded as a loss or lessening of self" [3].

Long time usage of smartphones by the kids lead to musculoskeletal problems due to the faulty posture maintained like forward neck posture problems, rounded shoulder or slouched posture for a prolonged period of time [4]. The structural problems caused by faulty posture may lead to decrease in proprioception there by resulting in decreased balance ability. The maintenance of proprioception is

extremely important in order to prevent injuries & this is mainly subjected to proprioceptive input from mechanoreceptors in the capsule, ligament & tendon added to vestibular & visual input to central nervous system.

The proprioceptive system is part of the central nervous system. Proprioception is one's personal sensation of the body. Proprioception is the feel arising from joints, muscle groups, tendons and related deep tissues that offer statistics to the central nervous system (CNS) about static and dynamic motion of limbs and the body. Proprioception information is processed at exclusive levels of the central nervous system in order to meet physical needs positioned at the body and aides a mover to arrive at motor choices. Proprioception strongly contributes to the fitness of joint balance; sensing passive or energetic joint articulation; joint load absorption and rebound; and muscle duration, force and velocity. Abnormality and tissue trauma excluded, the proprioception is a basic part of all people's neuro-anatomy [5].

The proprioception experience end result of a collection of fact derived from sensory receptors found within, muscular tissues, tendons, ligaments and fascia. The sensory receptors answerable for proprioception are referred to as mechanoreceptors and are the subgroup of somatosensory system. All mechanoreceptor facts is grouped collectively in the central nervous system (CNS) and are processed at distinct ranges of the consistent with unique movement and environmental demands.

The proprioception information is blended with body senses on a moment by using secondary basis for the duration of real time events. The simultaneous interaction of many sensory procedures create a collective internet notion of the body in area and contributes to motion choices.

Nonpublic, bodily and perceptual sources are mixed with genetic, cultural and societal sources as contributing factors to motion or action selections. Throughout the body & nervous system proprioception plays the role of a loop which continuously feedback & forward input. The vital importance of optimal orientation and postural control is relied on the complex reflex & central interaction between cervical proprioception, vestibular & visual information [6]. When there is an increased use of smartphone by the kids the proprioception lies at the boundary between neurophysiology & neuropsychology. The nomophobia children will soon develop poor balance, poor co-ordination and increased postural sway.

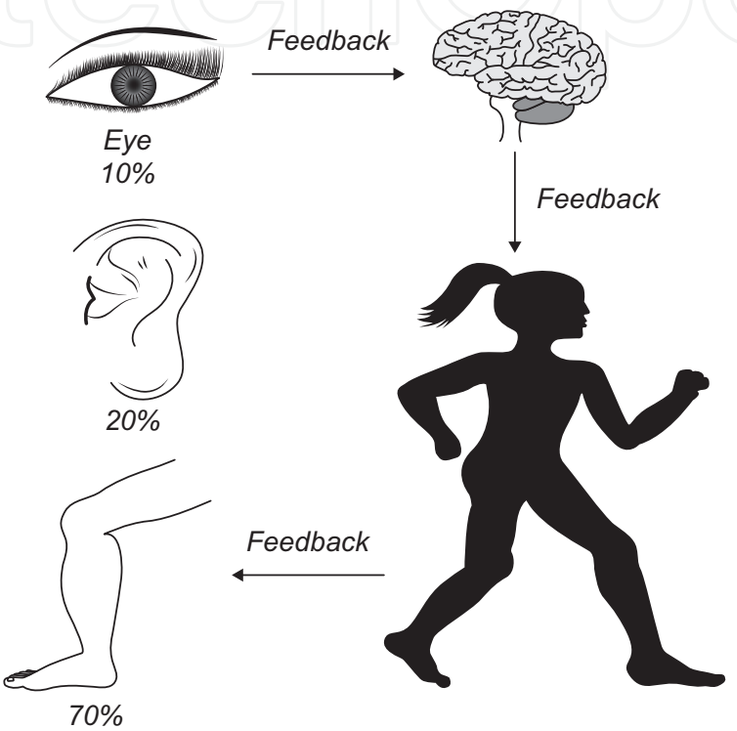
From an engineering perspective the human neuro musculoskeletal machine can be appeared as a robot, consisting of a linkage system (the skeleton) with motors (muscles), sensors (proprioceptors), and a control gadget (the CNS) [7]. The nerves and neurons are the wires and connectors, which shipping the data from the proprioceptors to the CNS and from the CNS to the muscular tissues.

The CNS integrates intentions with facts from the proprioceptor to coordinate motion ofthe skeleton through selectively (de-)activating muscle groups. Manage engineers will directly recognize a feedback loop: the movement outcomes from commands from the CNS, which on their flip (in part) rely upon the movement sensed via the proprioceptors there is a mutual interaction among CNS and limb movement. Postural manipulate is a specific case inside human movement control [8].

The human has to maintain a posture, i.e. an equilibrium position. At some point of postural manipulate unbiased strategies contribute to stability and performance: (1) intrinsic residences of the muscles and (2) proprioceptive reflexes. Balance is controlled and maintained by a complex set of sensory-motor control system which include the sensory input, receptors, input from vestibular system, integration of sensory input and the motor output [9].

All children receive information from their internal and outside environments through the following senses: imaginative, motion (vestibular), prescient (ocular), hearing (auditory), taste (gustatory), odor (olfactory), contact (tactile), Joint and muscle cognizance (Proprioceptive).

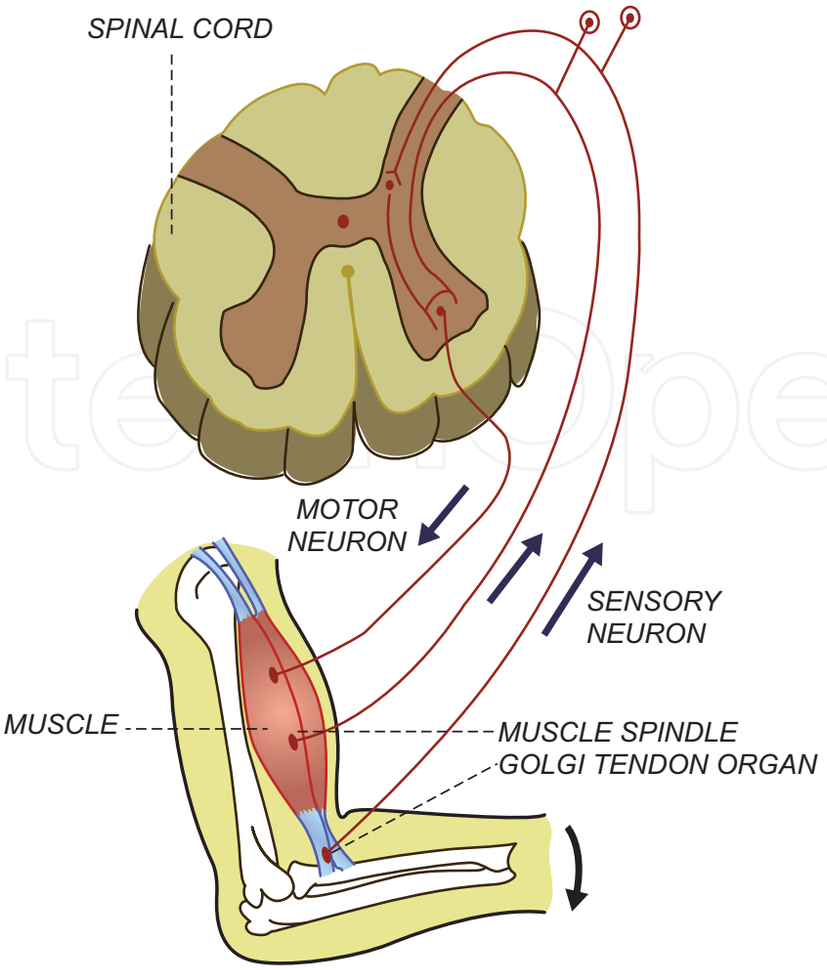
The term sensory integration refers back to the manner of receiving and responding to the incoming facts. It starts off evolved while your toddler gets information from their senses, then the vital nervous device directs the records to the correct parts of the mind, and the records is integrated so the child can reply in the perfect manner.



2. Proprioceptive receptors

The term proprioceptor comes from the Latin 'proprius', one's own, and 'recipio', to get. It was characterized by Sherrington (1906): 'In muscular receptivity we see the body itself going about as an upgrade to its own receptors – the proprioceptors'. Types of proprioceptors include muscle spindle, golgi tendon organs and the mechanoreceptors in the joint capsule.

When muscles lengthen, the spindles gets stretched. This stretch activates the muscle spindle that successively sends an impulse to the neural structure. This impulse leads to the activation of a lot of motor neurons at spinal level that send an impulse back to the muscle [10]. The Golgi connective tissue Organ could be a propioception receptor that's situated at intervals the tendons found on every finish of a muscle. It responds to inflated muscle tension or contraction as exerted on the connective tissue, by inhibiting any muscular contraction. Mechanoreceptors meant as primary neurons or nerve endings that reply to mechanical stimuli by firing action potentials. When mechanoreceptor receives a input, it begins to fire action potentials at raised frequency [11].



3. Proprioceptive system

Proprioceptive system has three overlapping major functions:

1. Regulation of tone

Posture and body movement is mediate by proprioception through the afferent information it receives from all sensory receptors, and by the efferent data it sends to the extrapyramidal motor tracts.

2. Egocentric abstraction localization

By integration and modulating the knowledge that comes from sensory receptors, the proprioceptive system informs the brain about the relative position of the sensory organs, the relation between every body segment, and also the relative position of the body within the close setting.

3. Modulation of multisensory data

Proprioceptive data well-known to be transmitted within the multisensorial deep layers of the nerve center within the midbrain is believed to possess a task in modulating multisensory integration. This modulation has consequences in motor behavior and better psychological feature functions [12].

4. Eyes and Proprioception in nomophobia

The receptors of proprioception as major role in movement of eye control and construction of extra personal space. It was Thomas Reid in 1785 who clearly explained the mechanism of the function of eye proprioception. The visual gaze direction as direct concern with the neck muscles control during vestibular stimulation. The extra ocular muscle afferent signals are determined in patterned inhabitation of forelimb and neck muscles & there by influence the head position on the body [13].

Its miles possible to steer body proprioception by using stimulating no longer simplest direct mechanoreceptors like neuromuscular spindles, or joint or tendon neurologic terminations, however additionally through modulating the information from different sensory input as well. These range from visible receptors linked to the retinocolicular pathway in the uppermost location of the body to the only plantar receivers underfoot.

Brain will tend to combine various available source of extra-retinal signals to foster visual clarity during eye and head movements with proprioception as major contribution visual fatigue caused by usage of smartphones for a prolonged period of time as highly impact with visual ability to control posture thereby reducing the ability to balance. Thus it is very clear that continuous usage of smartphones by the kid for the sake of games & YouTube may lead to posture and balance disturbances through visual gaze [14].

5. Muscle, joints and proprioception in nomophobia

Proprioception is a chain of feedback between the sensory receptors which are located in the skin, joints and muscles when the duration of smartphones usage increases it will surely have an negative impact of cervical proprioception & dynamic balance ability.

Prolonged flexed neck, posture in turn will increases the muscle activity which will cause the musculoskeletal pain in neck and shoulder on comparison fast muscles, muscle fibers cause more fatigue than slow muscle fiber when static posture is maintained for a prolonged duration as the cervical flexion angle is decreased. When the head is inforward headed posture the muscular tissue perform cervical extension in the back of the neck are contracted isometrically creating a force which is against gravity, which will lead to prevention of cervical flexion or forward head movement, & long term isometric contraction of the muscles in the back of neck involved in the extension of cervical & can also cause pain by stimulating trigger points. The combination of extension within the higher cervical region and flexion within the lower cervical region seems in patients with forward head posture attribute to head posture. Changes in the cervical region by sustained poor head posture, cause excessive joint and muscle loading, and later on influencing weakness of the deep cervical muscles. Among several body structures set within the cervical region, the muscle is thought to be a main part for position sense through its receptors, like muscle spindles. The cervical vertebrae contribute proprioception sense input [15].

The proprioceptive sensing of the cervical vertebrae transmits data to correct arrangement and plays a crucial role in bodily property management. Additionally, it reacts sensitively to the fine movement of the top by acting in coordination with sensing from the vestibular apparatus. Asymmetrical alignment of the top and neck ends up in errors within the data received as visual and proprioception sensing this

eventually reduces the balance and will increase the chance of falling and contractile organ injuries whereas acting activities.

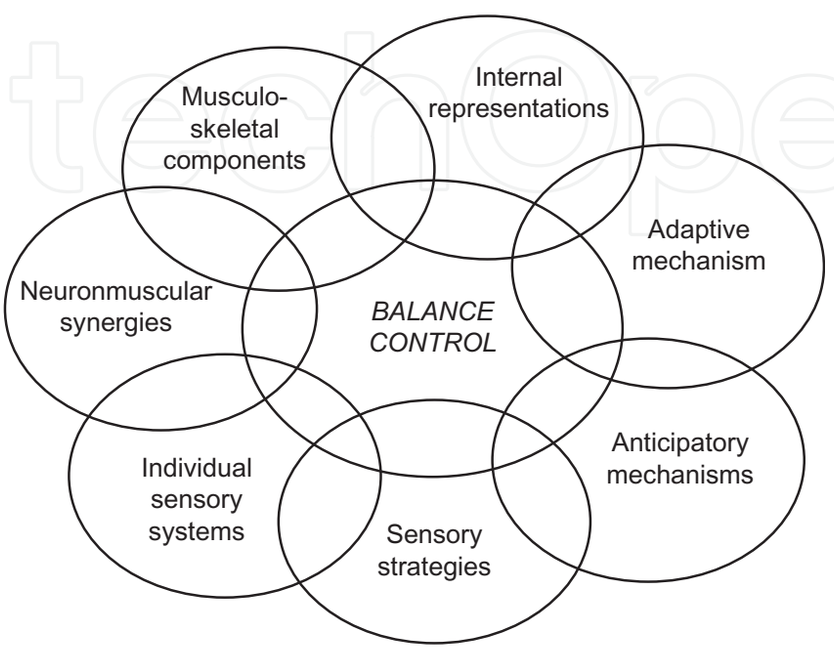
6. Vestibular system and proprioception in nomophobia kids

The central and peripheral vestibular organs, in conjunction with the visual and somatosensory systems, are responsible for balance, equilibrium, and orientation in space. Vestibular system as major role in subjective awareness of body position and movements in space, postural tone and equilibrium and stabilization of the eyes in space during head movement along with visual system and proprioception continuous use of smart phones may lead the child hyper expressive and also lead to gravitational insecurity, which is an sensory integration issue which may cause to react to movements in an extreme way. This is due to the impact of vestibular system by which the child's gravity receptors become extra sensitive.

7. Motor control and proprioception in nomophobia kids

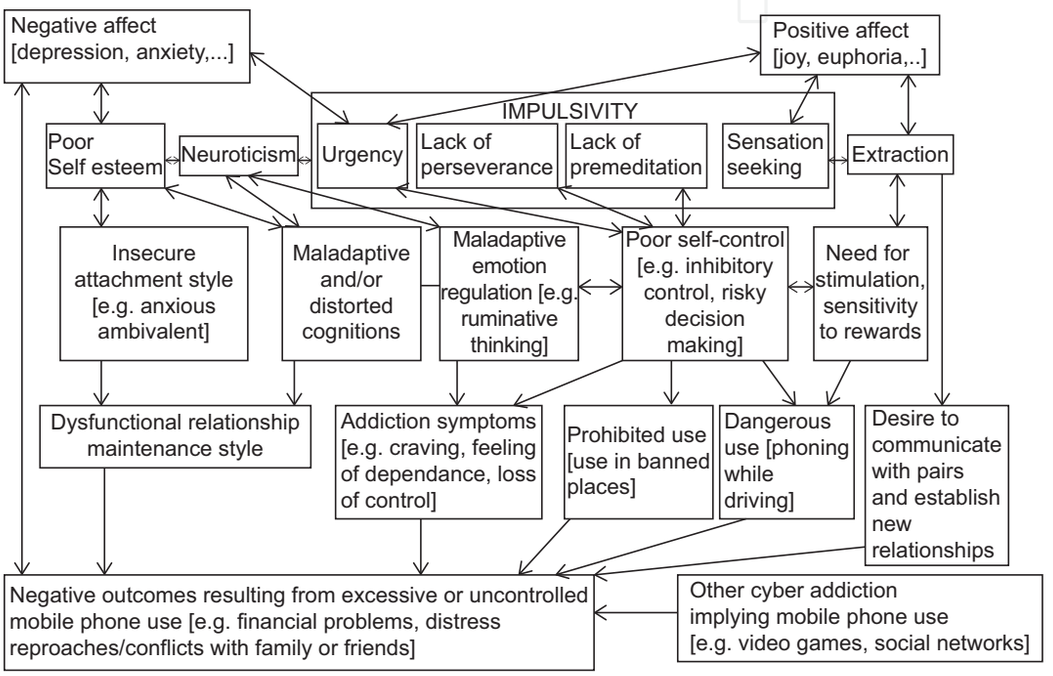
Proprioception is caused out to all the levels of central nervous system where it gives out unique sensory component to effectively use motor control neuromuscular control of dynamic restraints very necessarily needs proprioceptive information. The motor control is disturbed in nomophobia kids through stress imposed on other bodily system. Perception is extraordinarily necessary in control as a result of it carries the relevant info concerning objects, environments and bodies that is employed in organizing and initiating actions and movements.

proprioceptive data plays an integral role within the ability to change internal models used with feed forward management that has been incontestible to be solely part paid for by visual information. The planning of movements additionally needs attention to environmental constraints. Children using smartphone for a prolonged period of time lack attention thereby their planning and control of movements is not proper.



8. Proprioception impairment in nomophobia kids

- Balance Issues
- uncoordinated Movement
- Clumsiness
- Poor Postural Control
- Trouble Recognizing Your Own Strength



- Avoiding Certain Movements Or Activities

9. Proprioception assessment

There are a few test Physiotherapists can use to assess proprioception, depending at the body element being assessed. That includes:

Heel-shin:

The patient is asked to the touch the heel of 1 foot to the opposite knee after which to drag their heel in a instantly line all of the way down the front in their shin and lower back up once more. With a view to get rid of the impact of gravity in moving the heel down the shin, this test have to continually be done in the supine position [16].

Finger-nose-finger:

The subject is asked to alternately touch their nose and the examiner's finger as fast as possible [3].

Distal proprioception test:

The tester will be made to circulate the joints of the hip, knee ankle and big toe up and down as it is watched. Then ask the subject to repeat the equal movement together with eyes closed.

A contralateral joint matching task:

Asking the affected person to match a verified joint angle, and measuring the distinction among the real joint angle, and the reproduced joint perspective.

Romberg's test:

The affected person is requested to remove his/her footwear and stand with two feet together. The clinician asks the patient to first stand quietly with eyes open, and ultimately with eyes closed. The Romberg test is scored by counting the seconds the person is able to stand with eyes closed [3].

Spinal Motion Apparatus:

This procedure developed by Pankhurst and writer for assessing the proprioception of lower back. It is composed of a motor operated device that produces passive motion of lumberspine in three planes whereas the trunk stayed fastened. The apparatus detects motion and identifies the neutral position and the direction of movement. It assesses movement in 3 planes as advantage, but the employment during a clinical population might not be possible because it utilizes the advanced equipment [17].

Active Movement Extent Discrimination Device:

Developed by Hobbs to assess lumbar proprioception. It depends on discriminating the position differences in 11–19° of lumbar flexion. It consists of free standing with stopper at five preset distances. The subject had to discriminate preset trained flexion positions while standing. The test's disadvantage is that the subject's head is also moving through the test so the vestibular system might be adding to the proprioception sense [18, 19].

Cervicocephalic Kinesthesia:

Kristjansson et al. described the test. It has fast track sensors. Various uses of the test described such as relocation of the head to the natural position after active turn to left and right or active relocation to 30° turn from the natural head position. Passive trunk rotation of 30° or figure of eight motion can also be used before subjects repositioning head to a natural position [8].

Limb Position Copying and Reproducing Tests:

Described by Kaplan [7]. This test can be used for assessing the proprioception of various joints such as knee or elbow. The test requires active reproduction of ipsi- and contralateral positions of the limb. Goniometer measures the error between reproduction and the target.

Precaution to overcome nomophobia in kids:

- Delete all the social media apps on mobile phones.
- Set specific boundaries for usage of smartphones.
- Lock the smartphones with long password.
- Parents spend time with kids playing with them.
- Parents avoid smartphones before kids.

10. Intervention

Chair based exercises

- Hand pushes
- Hand pulls
- Head compressions
- Chair push ups
- Theraband on chair
- Squeezing a stress ball

Classroom based exercises

- Wall pushes
- Push ups
- Lifting weights e.g. tins, books, dumbells
- Jogging on the spot
- Star jumps
- Bouncing on therapy/exercise ball

Other exercises

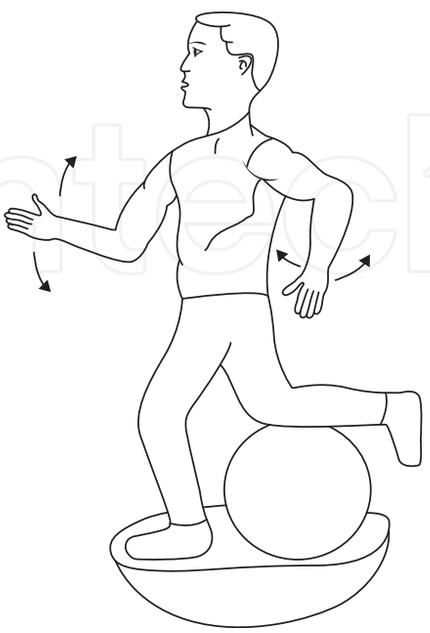
- Climbing wall bars/ropes
- Throwing/catching weighted ball
- Crawling obstacle course
- Wheelbarrow walks
- Gymnastics- handstands, cartwheels, using gym equipment
- Jumping e.g. hop scotch
- Tug of war
- Bouncing on space hopper
- Lying on stomach over exercise ball and weight-bearing through arms

Functional activities

- Wiping benches and tables
- Brushing/mopping floors
- Holding doors open
- Carrying piles of books
- Carrying a backpack with a heavy item in it
- Stacking chairs
- Moving furniture

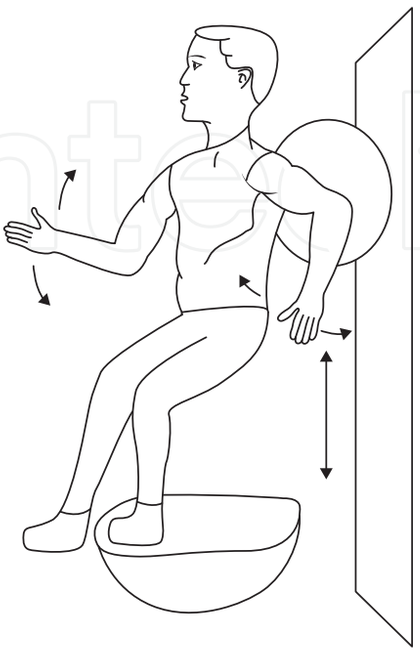
Proprioception ativity using swiss ball

- Roll it up on a wall.
- Dribble it. Pushing the ball into the ground is great for the proprioceptive sense as well as when it bounces back.
- Bounce on it alone.
- Kick it against a wall.

INITIAL PHASE – The first 3 weeks	**FINAL PHASE – The last 3 weeks**
EXERCISE 1 Initial phase: From the position indicated in the picture, to do shoulder flexion – extension. 	**EXERCISE 1** Final phase: the same performance but now each hand holds a 2 kg weight which increases 1.5 kg per week. 
30″ each limb	30″ each limb

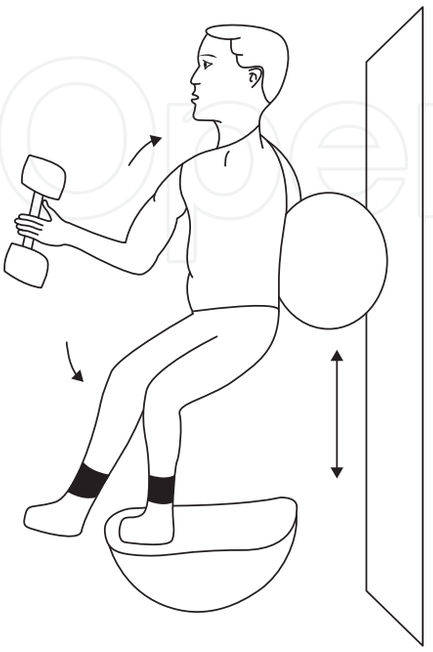
INITIAL PHASE – The first 3 weeks	FINAL PHASE – The last 3 weeks

EXERCISE 2
Initial phase: From the position of the picture, doing hip flexion – extension at the same time that moving the shoulder in flexion – extension.



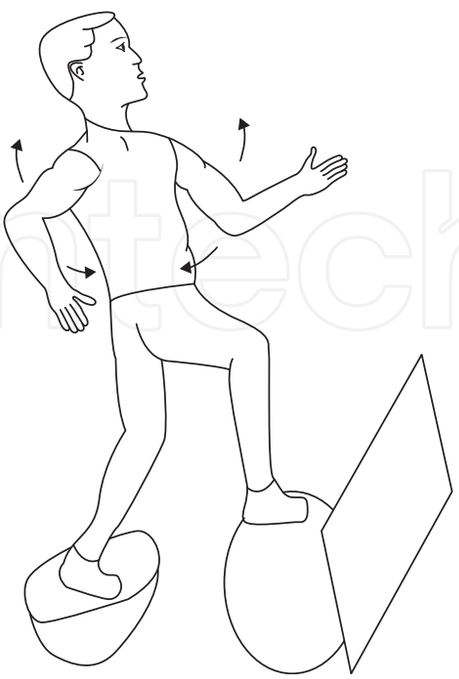
10 times each limb

EXERCISE 2
Final phase: The same performance apart from each hand hold a 2 kg weight which increases 1.5 kg per week and a 3 kg ankle weight in each ankle.



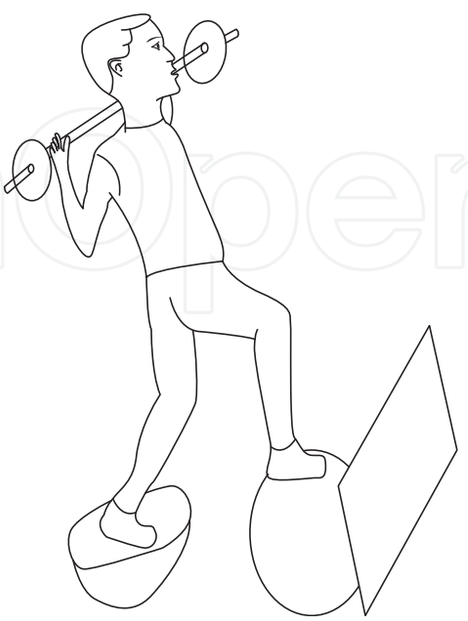
10 times each limb

EXERCISE 3
Initial phase: From the position indicated in the picture, to do shoulder flexion – extension.

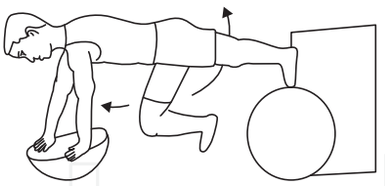
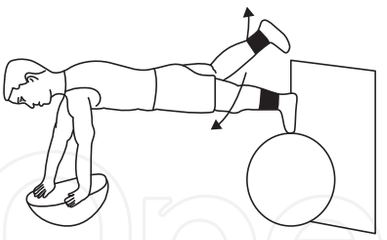
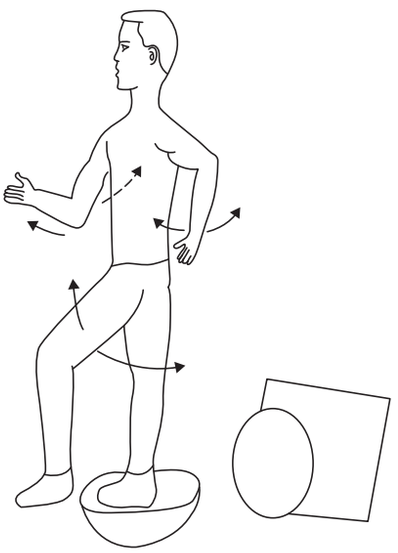
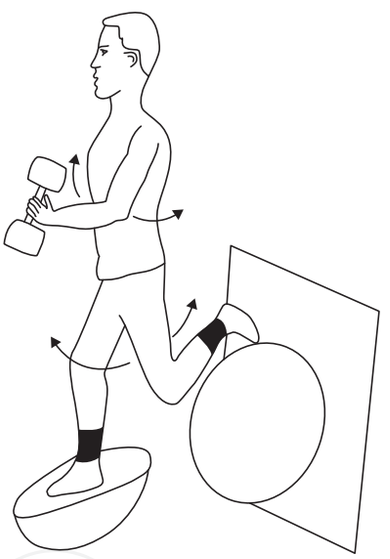


30″ each limb

EXERCISE 3
Final phase: The same performance but now each hand hold a 2 kg weight which increases 1.5 kg per week and the back leg is supported over the metatarsals.



30″ each limb

INITIAL PHASE – The first 3 weeks	FINAL PHASE – The last 3 weeks
EXERCISE 4 Initial phase: The free leg does a whole circulation which ends with the extension hip.  10 times each limb	**EXERCISE 4** Final phase: The same performance apart from a 3 kg ankle weight in the free leg.  10 times each limb
EXERCISE 5 Initial phase: The free leg does hip, knee and ankle flexion synchronized with the high member which also moves in flexion – extension.  10 times each limb	**EXERCISE 5** Final phase: The same performance apart from each hand hold a 2 kg weight which increases 1.5 kg per week and also a 3 kg ankle weight in each ankle.  10 times each limb

11. Conclusions

In line with King et al. [2], this study purports that nomophobia, or no mobile phone phobia, is thought of a contemporary age phobia introduced to our lives with the speedy proliferation and adoption of smartphone.

The proprioceptive system has an extensive influence at the protection of human fitness. When the proprioception is dysfunctional, the vital anxious device does no longer recognize the ideal fame of tonicity ofthe muscular tissues at rest or in motion, does no longer combine effectively the records that comes from sensory receptors, and has issue in modulating multi-sensory integration, with outcomes in motor behavior and cognitive function. This outcomes in a wide variety of proprioceptive abnormalities which are clinically related and are handled collectively termed as Postural Deficiency Syndrome (PDS). Kids using smart phones for a prolonged period of time lack attention, lack posture and motor control. Smart

phone usage for extended period may change the brain activity, and postural disturbance.

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